

Optimizing Soybean Emergence and Early Growth

- Management practices can be implemented to help increase soybean yields and revenue.
- This includes cultural practices such as planting date, seeding rate, planting depth, and row width.
- Soil fertility, weed control, and the use of seed treatments are other practices that can help optimize soybean emergence and early growth.

Soybean Germination and Emergence

Weather and soil conditions affect soybean germination and emergence. Air and soil temperatures of 55-60° F are needed for seed germination and seedling growth. Planting into a moist seedbed with good seed-to-soil contact is necessary so moisture can move into the seed for germination to occur (Figure 1). The radical, or primary root, is first to emerge from the seed in the soil. The hypocotyl is the seedling structure that emerges through the soil surface exposing the soybean cotyledons to sunlight (Figure 2). After seedling emergence, the young stem and first leaves can grow upward, beginning a phase of rapid vegetative growth for about six to eight weeks (Figures 3 and 4).

Soybean seeds can begin to germinate at soil temperatures around 50° F. However, planting soybean seed in soils less than 55° F can slow emergence for up to several weeks and often reduces seedling vigor. Cold soil temperatures can cause seeds to lay dormant and become increasingly vulnerable to diseases, insects, and animal feeding. Seedling emergence should occur in less than a week when soil temperatures are between 70° F and 90° F. Soil temperatures above 95° F can also cause soybean germination and emergence to be extremely poor resulting in reduced stands.

Soil temperature, moisture, and oxygen affects soybean emergence. Saturated and flooded soils can reduce germination and emergence due to lack of oxygen. Soil compaction can reduce seedling germination, root and plant growth, and nutrient uptake. Soil crusting can also delay or prevent seedling emergence and cause soybean hypocotyls to be swollen or broken when trying to push through the crust. Fields with fine textured soils, low organic matter, and little surface residue can be vulnerable to crusting, especially where excessive tillage has taken place. If irrigation is required for good soil moisture, it should be applied ahead of soybean planting, and not immediately after planting. Planting into dry soil with rainfall or irrigation soon after can result in crusting and poor soybean emergence. Waiting for favorable soil temperatures, moisture, and planting conditions helps soybean germination, emergence, and early growth.



Figure 1. A soybean seed needs to absorb 50% of its weight in water to germinate, and for the radical to emerge. Dry planting conditions can lead to partial seed imbibition and poor germination.



Figure 2. Soybean emergence occurs as the hypocotyl elongates pushing the cotyledons through the soil surface. Planting depth and soil conditions are important for good seedling emergence.



Figure 3. Soybean seedlings with fully expanded cotyledons, unifoliolate leaves, and growing point above the soil surface. Emergence can occur in less than a week under optimum planting conditions.



Figure 4. The soybean crop should develop a closed canopy as early as possible. Canopy closure can be affected by planting date, seeding rate, and row width.

Planting Date

Planting soybean seed during the optimum time period for the area usually provides for rapid seed germination, emergence, and growth. Soybeans have a reasonably large period of time that can be acceptable for planting. Planting too early or too late, outside of the acceptable time period, can lead to poor stands due to excessively cold or hot soil temperatures.

Optimizing Soybean Emergence and Early Growth

Slow emergence and growth will often occur with early planting dates. However, planting should generally occur as early as possible within regional, state, and product guidelines. If the entire crop cannot be planted during the optimum time, it is better to begin planting early rather than risk late planting. Planting early generally requires more management. Adoption of the early soybean production system and conservation tillage practices can increase the potential for delayed seed germination and emergence, often requiring an increase in management practices. The maturity group of the soybean product also plays a large role in making planting date decisions.

Other Cultural Practices

Soybean seed should be planted 1 to 1.5 inches deep and generally no deeper than 2 inches. The plant can utilize a lot of energy as the hypocotyl straightens carrying the cotyledons to the soil surface. Therefore, planting too deep can burn energy that could be used later by the plant. In addition, planting too deep can inhibit emergence in stressful situations, such as soil crusting and compaction. Deeper planting can be desirable when moisture availability is at a deeper depth. Shallower planting is desirable when planting early in cooler soils and the potential for significant rainfall is high. Shallower planting would also allow the seed to emerge more rapidly through a crusted soil.

Seeding rates should be made on a field-by-field basis, referring to specific recommendations for a given geography. The seeding rate should always be chosen to facilitate a final stand that can optimize yield potential according to emergence conditions. More difficult planting conditions generally require a higher seeding rate.

High soil fertility and chemical weed control can reduce the need for high seeding rates. Soybeans grow best on soils of medium to high fertility and favorable soil pH. Fertility is one of

the most overlooked areas in soybean production, and soil testing can indicate whether a field has additional fertilizer needs. Excessive weed growth can slow soil drying and warming and affect seedbed quality and crop establishment, including timely planting. Row spacing is generally not as important for soybean emergence and early growth as other considerations, such as planting date and product selection. Proper selection of planting date and row width can affect canopy closure, and it is extremely important for weed management to obtain closure as early as possible.

Seed Treatments

Seed treatments help promote seed germination, seedling establishment, and early vigor. In addition to the disease and insect protection properties of seed treatments, they can help to improve plant health under certain colder conditions. Seed treatments can especially help in the following conditions:

- Planting early in cool, wet soils
- Planting late in hot conditions such as in no-till double crop
- Planting into heavy vegetation
- Planting on poorly drained or high clay content soils
- Planting in fields with a history of seedling disease and insect problems.

Seed treatments also become more important with early planting and reduced seeding rates, which can cause problems obtaining a good stand with insect and disease pests.

Summary

Planting soybeans at the proper depth and seeding rate, when temperature, moisture, and soil conditions are favorable, is very important to give the crop the best chance of emerging properly and growing quickly.

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Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.

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